REMARKS

This response addresses the issues raised by the Examiner in the Office Action mailed February 10, 2005. Initially, Applicants would like to thank the Examiner for the careful consideration given in this case. Claims 22-38 and 43-45 are pending in this case all to more clearly and distinctly claim Applicants' invention. In view of the following remarks, Applicants submit that the presently pending claims are in condition for allowance and notification of such is respectfully requested.

Rejection Based On Obviousness-Type Double Patenting

The Examiner rejects Claims 22-25 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-4 of U.S. Patent No. 6,537,270. More specifically, the Examiner states that the conflicting claims are not patentably distinct from the present claims because they are directed to analogous devices for shaping the surface of an object with a laser beam, the devices comprising pulsed laser sources; a beam deflector; and micro-optically active structures that shape the intensity distribution of the laser beams after passing through. Applicants respectfully requests reconsideration of this rejection.

An important feature of the present invention as claimed in independent claim 22 is the unique optical element that can influence the intensity distribution in the laser beam cross-section such that the laser beam has a Gaussian distribution. This unique feature provides the advantage of a very smooth overall surface and no steplike, steep structure remains on the surface, which results in a substantial reduction in treatment time, especially in the correction of curvatures of the cornea. This feature is not recited in any of claims 1-4 of the '270 patent. This feature is also certainly not obvious from the '270 patent. Accordingly, Applicants respectfully requests the withdrawal of this rejection.

Rejection Based On James Under 35 U.S.C. § 102 (b)

The Examiner rejects Claims 22-28, 30, 35, 38, 43 and 44 under 35 U.S.C. § 102 (b) as being anticipated over U.S. Patent No. 5,463,200 to James et al. ("James"). Applicants respectfully traverse this rejection.

For a rejection to be sustained under 35 U.S.C. § 102 (b) each an every element of the claimed invention must be disclosed or cited in the prior art reference. The present invention discloses a device for shaping an object, such as an eye, by the removal of material from the surface of the object. The device of the present invention comprises a pulsed laser beam, a deflecting device through which the laser beam is guided over the surface of the object, and an optical device provided for changing the distribution of the radiation intensity inside the laser beam cross section having at least one optical element with a microoptically active structure. The present invention further discloses that the microoptically active structure has a diffractively active element structured in the micrometer range whose dimensions approximately correspond to the wavelength of the pulsed laser beam, where the microoptically active structure influences the intensity distribution in the laser beam cross section in such a way that the laser beam, after passing through said optical element, has a bell-shaped or Gaussian intensity distribution, or an intensity distribution similar to a bell-shaped or Gaussian distribution, in at least one cross-sectional direction.

Further, one of the advantages of the present invention is that a very smooth overall surface can be realized very quickly when spots with a Gaussian intensity distribution overlap. See Specification at page 4, lines 1-5. Accordingly, no steplike, steep structure remains on the surface of the object that is shaped with the device of the present invention. See Specification at page 4, lines 5-6. Therefore, subsequent treatment of the surface is required only to a limited extent or not at all. As a result, the treatment time can be substantially reduced especially in the correction of curvatures of the cornea with the present device

James discloses a method of marking a workpiece in a selected pattern with light energy from a primary light beam, comprising the steps of: (a) transmitting to the workpiece portions of the light of the primary beam required to produce marks on the workpiece, while at least partially absorbing or redirecting the remainder of the light of the primary beam, and (b) converting at least such mark-producing portions of the primary beam into a plurality of individual beamlets each focused independently of the other beamlets; said transmitting and converting steps being performed sequentially in either sequence, the beamlets corresponding to said mark-producing light portions forming respective marks on the workpiece that are disposed in an array corresponding to the selected pattern. See Col. 3, lines 11-25. In other words, James discloses a technique for ablating material by means of a laser beam in which the laser beam is directed through a template 22 (stencil mask 22) to an area of the surface of the object from which material is to be ablated. See Columns 4-5, lines 24-67 and lines 1-7,

respectively. In James, the laser beam remains directed to the area of the surface from which material is to be ablated throughout the entire material ablation process without changing. A height profile is generated within the area of the surface on which the laser beam is directed, in which the height profile has zones from which material was removed and zones from which no material was removed. This requires that only the zones from which material is to be removed are exposed to the laser radiation within this area.

James accomplishes this by using template 22. Template 22 has a pattern of transparent and opaque areas so that beam components impinging on the opaque areas of the template 22 are blocked whereas the beam components passing through the transparent portion of the template 22 impinge on the surface. In other words, the pattern of transparent and opaque areas of the template 22 is imaged on the surface in the form of illuminated "light" zones and un-illuminated "dark" zones. As a result, material is removed in the "light" zones and no material is removed in the "dark" zones. In this way, a height profile corresponding to the pattern on the template 22 is formed on the surface of the object. See Column 5, lines 2-4 and Figure 3. Accordingly, the technique described by James is in the field of "mask imaging marking method" which is further described in Column 2, lines 10-30.

To generate different height profiles, it is necessary either to change between different templates 22 or to use a controllable template in which the ratio of the transparent to opaque areas can be altered by a corresponding control such that a pattern corresponding to the desired height profile results on the template. The latter alternative is described in a special construction in James referring to Fig. 14, wherein the template is formed as a controllable "light modifying device 26A." Also, note that in James, the laser beam does not impinge directly on the surface of the object after passing through the template 22, but rather first passes through a microlens array 14. The microlens array 14 ensures that the illuminated "light" zones on the object surface are illuminated with a uniform beam intensity in order to avoid unevenness after ablation of material within these zones. A diffractive microoptic microlens array is used, for example, as microlens array 14 (see column 4, line 56, to column 5, line 7).

James does not teach or suggest that the cross-sectional area of the laser beam is smaller by a multiple than the two-dimensional extension of the surface region to be worked. Instead, James discloses that the cross-sectional surface of the laser beam has the dimensions of the surface region that is to be worked. In addition, James does not teach or suggest that the laser beam is not fixedly directed to the surface region to be worked. In the present

invention, a deflection device is provided which guides the laser beam over the surface region, and this laser beam generates small spots of light on the surface which are deflected so as to scan the surface region and thus the input of energy and the removal of matter is affected in these spots. Further the "light modifying device 26" mentioned by the Examiner is only a device for modifying light that is controlled by a computer to achieve the same effect as a fixed template. See Column 7, line 67 to Column 8, lines 1-2.

In contrast, in the present invention, the laser beam is guided spot by spot only over the zones of the object surface from which material is to be removed, wherein the spots are placed successively in time and adjacently spatially. The laser beam is not directed to zones from which no material is to be removed and these zones are not touched by the spots. Here, a template is not provided or needed. Also, the microoptic structure in the present invention has a different function that in James; namely, when the spots are placed adjacent to one another on the surface of the object and material is removed spot by spot, small raised portions on the order of magnitude of micrometers can be formed as a result in the border areas between two respective spots and the remaining surface is uneven on this order of magnitude. In order to prevent this unevenness, according to the present invention, the beam intensity within every spot is influenced in such a way that there is a greater intensity in the center of a spot than at the periphery, so that more material is removed in the center of the spot than at its periphery. However, the laser beam coming from the laser does not have this desired intensity distribution in its cross section. So, in order to impress the desired intensity distribution on the laser beam cross section, a microoptically active element is placed in the beam path, according to the present invention. The microoptically active element ensures that the intensity distribution in the beam cross section changes so that the spot can act in a corresponding manner.

Moreover, in the present invention, an optical device is provided "for changing the distribution ... wherein the microoptical active structure influences the intensity distribution in such a way that the laser beam, after passing through an optical element, has a bell-shaped or Gaussian distribution." James does not disclose this feature of the present invention. Further, James discloses that the microoptically active element, for example, a diffractive optical element ensures that the illuminated "light" zones from which material is to be removed are illuminated with a homogeneous beam intensity. This is unlike the present invention, where the microoptically active element serves to generate a deliberately inhomogeneously distributed beam intensity. The microoptically active element preferably generates an intensity distribution in this spot which is Gaussian; that is, the intensity is

highest in the center of the spot and declines toward the periphery. The microoptically active elements used in connection in the present invention are miniaturized optical components which influence the light propagation in three dimensions. They comprise a planar arrangement of a great many identical lenses, prisms or comparable elements that are arranged in arrays and whose dimensions range from less than 1 mm to a few millimeters. The elements can be constructed refractively or diffractively and act as grating structures.

Since James does not teach or suggest an optical elements that can generate a bell-shaped or Gaussian intensity distribution microoptic effective element, James does not disclose each and every claim element of the claimed invention. Therefore, Applicants respectfully requests that the rejection under 35 U.S.C. § 102 (b) be reconsidered and withdrawn.

Rejection Based On James In View Of Telfair Under 35 U.S.C. § 103(a)

The Examiner rejects Claims 29, 36 and 37 under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent No. 5,463,200 to James et al. ("James") in view of U.S. Patent No. 4,911,711 to Telfair et al. ("Telefair"). Applicants respectfully traverse this rejection.

To establish obviousness of a claimed invention, all claim elements must be disclosed, taught or suggested by the prior art. We agree with the Examiner that James does not teach or suggest that the optical element is mounted on a rotatable wheel and the method steps in which the surface is smoothed out. In addition, James does not teach or suggest an optical elements that can generate a bell-shaped or Gaussian intensity distribution microoptic effective element.

In regards to Telefair, Telefair discloses an apparatus for ablating material by means of a laser beam, in particular for correcting curvature of the eye. This apparatus has a beam homogenizing unit 22 which is composed of many individual elements with the object of generating a homogeneous distribution of the beam intensity in the entire laser beam cross section. It can be seen from Fig. 2 that this beam homogenizing unit 22 comprises a plurality of elements 20, 21, 50, 51, 52, 53 and 55. After passing through the beam homogenizing unit 22, the laser beam passes through a device 23 for influencing the beam. This device contains a plurality of filters A to H which are arranged on a filter wheel. The filters A to H have different characteristics and attenuate the laser beam differently within the laser beam cross section depending on these characteristics. To correct defective vision in the eye, a filter is selected by which the intensity distribution after passing through the filter is such that the corneal curvature is corrected by means of the ablation achieved by the input of energy. In

Telfair, the entire corneal area of the eye intended for the treatment is irradiated simultaneously and the cornea is ablated.

Accordingly, a distinction is made with regard to whether the defective vision is a myopia, in which the curvature of the cornea must be reduced, or a hyperopia in which the curvature of the cornea must be increased. In order to reduce the curvature of the cornea and thus correct the myopia, more tissue must be ablated in the center of the cornea than at the periphery. Accordingly, a laser beam having a higher intensity in its center than at its edge is required for this purpose. An intensity distribution of this kind is achieved in Telfair by means of filter A. The operation is described in column 6, lines 24-33:

In order to correct hyperopia, another filter, for example, filter B, is required. This filter has a higher transmission at the edge than in the center, so that when the laser beam passes through this filter an intensity distribution results in the laser beam cross section in which the intensity at the edge is higher than in the center. The operation achieved by filter B is described in column 6, lines 34 - 51:

Unlike the present invention, Telefair discloses that the cross-sectional area of the laser beam in Telfair is as large as the surface region that is to be treated and the laser beam is fixedly directed to this surface region. Also, one of the disadvantages of Telefair is that the curvature that can be achieved by ablation is always dependent upon the intensity distribution in the beam cross section. If different curvatures of the surface are to be achieved in different cases, adapted intensity distributions are required in the beam cross section and a separate filter must be available. This limits flexibility during treatment because it may happen, for example, that the desired curvature cannot be achieved with the available filters.

Spot-by-spot material ablation was developed to compensate for this disadvantage. This technique is used in the present invention. The advantage of spot-by-spot material ablation is that practically any curvature profile can be generated with the spot which is very small in relation to the surface to be corrected, specifically without having to change the intensity distribution in the laser beam cross section. The laser beam is controlled in such a way that more spots are directed successively in time to the places on the lens surface from which more material is to be ablated and, conversely, fewer spots are directed successively in time to the places on the lens surface from which less material is to be ablated. Accordingly, depending on requirements, the curvature can be increased by increasing material ablation from the periphery or the curvature is flattened by ablating more material from the center. Accordingly, Telfair differs substantially from the method and the arrangement in the present invention.

In the present invention, the cross-sectional area of the laser beam is smaller by a multiple than the surface region to be worked. In contrast to Telfair, the laser beam is not fixedly directed to the surface region intended for treatment; rather, the laser beam is guided over the area of the surface of the object spot by spot by means of a deflecting device and the spots are placed successively in time and spatially adjacent to one another. Energy is introduced in these spots and the corresponding material ablation is accordingly carried out. Areas of the surface from which less material is to be ablated or no material is to be ablated remain untouched by the spots or are illuminated by spots with lower intensity.

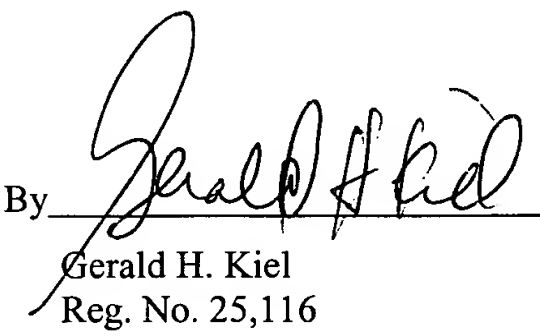
Thus, the Applicant believes that the amended invention is not obvious over the teaching of James in view of Telefair since James and/or Telefair do not teach, disclose or suggest the present claims. Moreover, one skilled in the art would find nothing in James or Telefair alone or in combination that would disclose, teach or suggest the claimed invention or any reason for making it. Further, there is no motivation to combine the references in such a way to get the claimed invention. Therefore, an obvious rejection under 35 U.S.C. §103 (a) is improper.

Allowable Subject Matter

Applicants thank the Examiner for indicating that Claims 31-34 and 35 are allowable if rewritten in independent form to include all of the limitation of the base claim and any intervening claims.

In view of the remarks presented herein, it is respectfully submitted that the present application is in condition for final allowance and notice to such effect is requested. If the Examiner believes that additional issues need to be resolved before this application can be passed to issue, the undersigned invites the Examiner to contact him at the telephone number provided below.

Dated: June 10, 2005

By 

Gerald H. Kiel
Reg. No. 25,116

Reed Smith LLP
599 Lexington Avenue
29th Floor
New York, NY 10022-7650
(212) 521-5400
Attorney for Applicants

GHK:ST/vh